

REMARKS

Claims 12-26 are pending and remain for consideration. Claims 12 and 24-26 are amended herein.

Claims 12-26 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Popovic et al. (U.S. Pat. No. 4,829,352). The rejection is traversed and reconsideration is respectfully requested, particularly in view of the clarifying amendments to the claims.

The present Response incorporates by reference the arguments for patentability raised in the previous Responses to Office Action dated April 25, 2007 and September 7, 2007.

Popovic addresses the problem that a Hall element should have a certain depth that cannot be realized in a conventional IC technology because the semiconductor layer accommodating the Hall element is very thin. So a Hall element realized in IC technology has certain disadvantages compared to an ideal Hall element. Popovic shows in figure 1 a Hall element. The Hall element has two contacts labeled c_1 and c_2 for supply and discharge of a current I flowing through the Hall element and two contacts labeled s_1 and s_2 for tapping the Hall voltage. The Hall element is cut by three horizontal section planes into four portions 1 to 4. The four portions are dispersed and corresponding points on each of the two sides of each section plane are connected to each other by electrically conductive wires. In figure 1 seven such wires are shown; the wires connecting portions 1 and 2 are labelled a_1 to g_1 ; the wires connecting portions 2 and 3 are labelled a_2 to g_2 , and the wires connecting portions 3 and 4 are labelled a_3 to g_3 . The invention of Popovic consists in that Popovic arranges the four portions in a new way, namely not below each other but next to each other as shown in figure 2a. Figure 2b shows a practical realization of the Hall element structure of figure 2a, but for the sake of simplicity only portions 2, 3 and 4 of the Hall element are shown in figure 2b. Figure 3 shows a

Hall element comprised of two portions only, and figure 6 shows the Hall element of figure 3 implemented as an integrated circuit.

So in summary, Popovic cuts a conventional Hall element with four contacts into a predetermined number of portions, disperses the portions from each other and connects corresponding points of adjacent faces by metallic wires, arranges the portions next to each other in a plane thereby stretching the metallic wires and implements the portions next to each other in a thin semiconductor layer. Metallic wires have substantially no resistance and are therefore not resistors.

A summary of the present invention is disclosed in sections [0010] to [0012]. The Hall element shown in figures 1 and 2 can electrically be regarded as a Wheatstone bridge comprised of four resistors. In order that the Wheatstone bridge be balanced, the four resistors must fulfil certain conditions. This condition is here $R_1 = R_2 = R_3 = R_4$. Because this condition is not fulfilled, an additional resistor is connected in parallel to the resistor R_4 and its resistance is chosen such that the condition $R_1 = R_2 = R_3 = R_4 || R_5$ is fulfilled. Popovic does not teach or suggest to add an additional resistor for any purpose.

The important differences between claim 12 of the present application and Popovic are:

1. The four Hall contacts are arranged on the surface of one and the same well of a first conductivity type. We amended claim 12 to expressly include this limitation. With Popovic the contacts 8 and 9 are arranged on the surface of a first well 2 and the contacts 10 and 11 are arranged on the surface of a second well 3. The two wells 2 and 3 which notably are individually labelled are electrically isolated from each other.

2. The entities a2 and c2 are not resistors as asserted by the Examiner; they are metallic connections (see col. 4, lines 49-57) and thus have essentially no resistance: the resistivity of the metallic connections is zero and it cannot be asserted that these connections are internal or external resistors.

3. The contacts 8 and 9 as well as the contacts 10 and 11 are neither configured for supply and discharge of a current flowing through the Hall element nor for tapping a Hall voltage. In figure 6 of Popovic the contacts for supply and discharge of a current are the contacts c_1 and c_2 formed as deep contacts 20 and 21, respectively. Figure 6 shows only one contact for tapping a voltage, namely the contacts 7 and 12 connected by metallic line b2 which is also labeled as sensing contact s_2 . For tapping a Hall voltage there are always two contacts needed because the Hall voltage is a difference between two voltages. The device shown in figure 6 of Popovic does not show two contacts for tapping a Hall voltage.

The same arguments apply to the other independent claims. With regard to claim 26, Popovic does not show two Hall elements. The invention of Popovic consists in dividing a single Hall element into different portions and arranging them in a new way to get a Hall element with improved characteristics.

However, in order to more clearly distinguish over Popovic, we amended the independent claims as follows:

1. We defined that the inner and outer contacts are arranged on the surface of the same well.
2. We stated that as a result of the additional resistor the resistance between the two outer contacts is substantially the same as the resistance between the two inner contacts. This limitation means that $R_2 = R_4 \parallel R_5$ when looking at Figure 4 or 5 of the present application.

To avoid any misunderstanding with regard to terminology in the previous discussion, the term "resistance" is the electrical ohmic resistance that can be measured by applying an electrical current to the respective contacts and measuring the voltage appearing at the respective contacts. (It is not the internal resistance).

The well at the surface of which the two inner and the two outer contacts are arranged is isolated from the surrounding area by a depletion zone of a PN junction formed between the well and the surrounding area. The width or size of the

depletion zone depends on the local voltage difference and therefore on the strength of the current. Therefore the resistance does not have a constant value like a normal ohmic resistor but slightly varies with the current. Although this effect is small it has an influence in that the resistance between the two inner contacts is hardly ever exactly the same as the resistance between the two outer contacts. For this reason we included the word "substantially".

For at least the reasons set forth above it with respect to amended independent claim 12, it cannot be maintained that Popovic discloses a magnetic field sensor comprising a Hall element having two inner and two outer contacts arranged along a straight line, and wherein the four contacts are arranged on a surface of a same well of a first conductivity type that is embedded in a substrate of a second conductivity type, and wherein the two outer contacts are connected by an additional resistor so that a resistance between the two outer contacts is substantially the same as a resistance between the two inner contacts. Having shown that the Hall element of Popovic and the claimed Hall element of the present invention as recited in claim 12 are structurally different, it cannot be maintained that Popovic anticipates claim 12, and therefore the rejection of claim 12 under 35 U.S.C. § 102(b) should be withdrawn and claim 12 allowed.

Claims 13-23 each depend directly or indirectly from claim 12 and therefore incorporate the limitations of claim 12. Accordingly, these dependent claims are allowable for at least the same reasons set forth for claim 12.

Amended independent claims 24-26 each generally recite the same distinguishing limitations as set forth above with respect to amended independent claim 12. For example, Popovic does not disclose disposing the four contacts on a surface of a same well of a first conductivity type that is embedded in a substrate of a second conductivity type, and wherein the two outer contacts are connected by an additional resistor so that a resistance between the two outer contacts is substantially the same as a resistance between the two inner contacts. For at least these reasons it

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cannot be maintained that Popovic anticipates amended independent claims 24-26, and therefore the rejection of claims 24-26 under 35 U.S.C. § 102(b) should be withdrawn and claims 24-26 allowed.

In view of the foregoing, it is respectfully submitted that claims 12-26 are in condition for allowance. All issues raised by the Examiner having been addressed, an early action to that effect is earnestly solicited.

No fees or deficiencies in fees are believed to be owed. However, authorization is hereby given to charge our Deposit Account No. 13-0235 in the event any such fees are owed.

Respectfully submitted,

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